

Metallic Joining to Advanced Ceramic Composites, Phase II

Completed Technology Project (2016 - 2020)



Project Introduction

The Orion Launch Abort System (LAS) utilizes attitude control motors (ACM) with advanced ceramic composite components that function as a valve control system to allow for safe maneuverability away from danger. This system is made steerable due to the valve controlled thrusters which utilize advanced ceramic pintles made of 4D C/C-SiC that are attached to metallic structures and actuated. During the Phase I effort, an innovative technique to join metallics with the advanced ceramic composites was demonstrated. Detailed characterization confirmed the deposited metal (Inconel 625) produced during this investigation had good adherence to C-C/SiC pintles and no interfacial reactions occurred during deposition or elevated temperature exposure. In Phase II, the joining interface will be optimized and pindle assemblies will be produced for hot fire testing with Orbital ATK. Additional CMC materials and components will also be developed.

Anticipated Benefits

Results of the Phase II will support the insertion of the joining technology of metallic to ceramic composite hot structures in the Attitude Control Motor of the Launch Abort System for SLS/Orion. Joining advanced composites to metal structures is applicable to existing and future NASA programs including the ACM motors of Orion MPCV's Launch Abort System, human Lunar ascent/decent, and the Commercial Crew motors; Nozzle extensions of upper stage engines for nanosatellite launch (e.g. ORBITEC's vortex liquid rocket engine) and ISS resupply (e.g. SpaceX's Merlin Vacuum liquid rocket engines); and RL10 engines, upper stage nozzle extensions; Nosetips, leading edges and control surfaces for hypersonic vehicles; turbine engine components, and exit cones and control vanes for tactical missiles.



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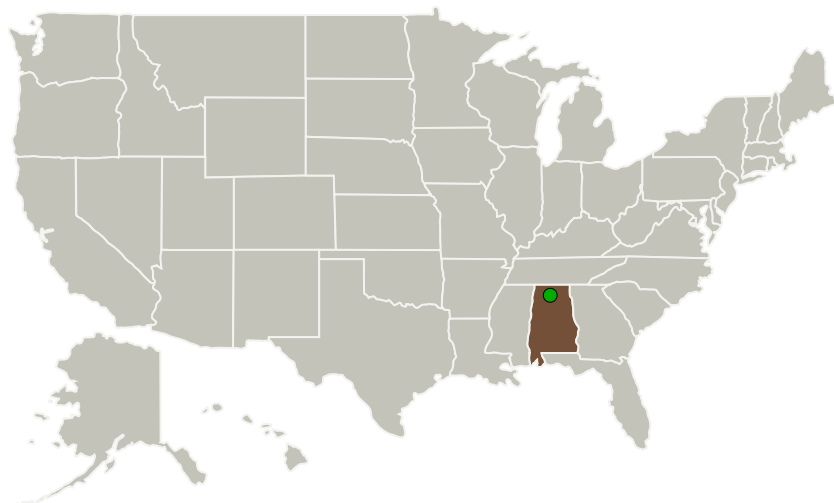
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Plasma Processes, LLC	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	Huntsville, Alabama
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Project Transitions

**June 2016:** Project Start**August 2020:** Closed out

Closeout Documentation:

- Final Summary Chart PDF(<https://techport.nasa.gov/file/139681>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Plasma Processes, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:Peter G Valentine
Gwenevere L Jasper**Principal Investigator:**

Timothy Mckechnie

Co-Investigator:

Timothy Mckechnie

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Images

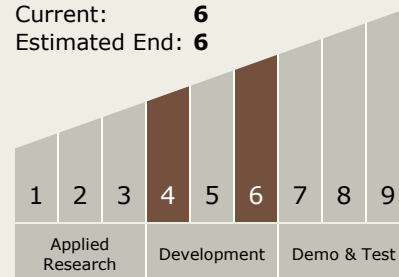


Briefing Chart Image

Metallic Joining to Advanced Ceramic Composites, Phase II
(<https://techport.nasa.gov/image/128607>)

Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System